Getting Started with the Threaduino

1 Overview

The Threaduino is a device based off of the Freescale FRDM-K64F board. This user manual is designed to guide users in the process of gathering the necessary resources and configuring the correct settings in the integrated development environment (IDE) in order to run an application. In this guide, we will be using a demonstration application from the Kinetis KW2xD SMAC Software package.

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2 Resources

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In order to be able to complete each step of this guide, you will need the following:

- Talon Threaduino Board
- IAR Embedded Workbench or other supported IDE
- Kinetis KW2xD SMAC Software
- P&E's USB Multilink Universal development interface
- BeeKit Wireless Connectivity Toolkit

NOTE: Install the BeeKit Wireless Connectivity Toolkit **before** connecting the board to your system. The drivers in this toolkit will allow you to use the device to its fullest potential. See Section 4 for detailed instructions.

2.1 Downloading and Installing IAR Embedded Workbench

The Oasis Tower Board supports many other IDEs, but for this guide we will be using IAR Embedded Workbench. Once you have downloaded and installed IAR Embedded Workbench, you will be asked to enter a license number. If you do not already have a license number, then click **Register with IAR systems to get an evaluation license.**

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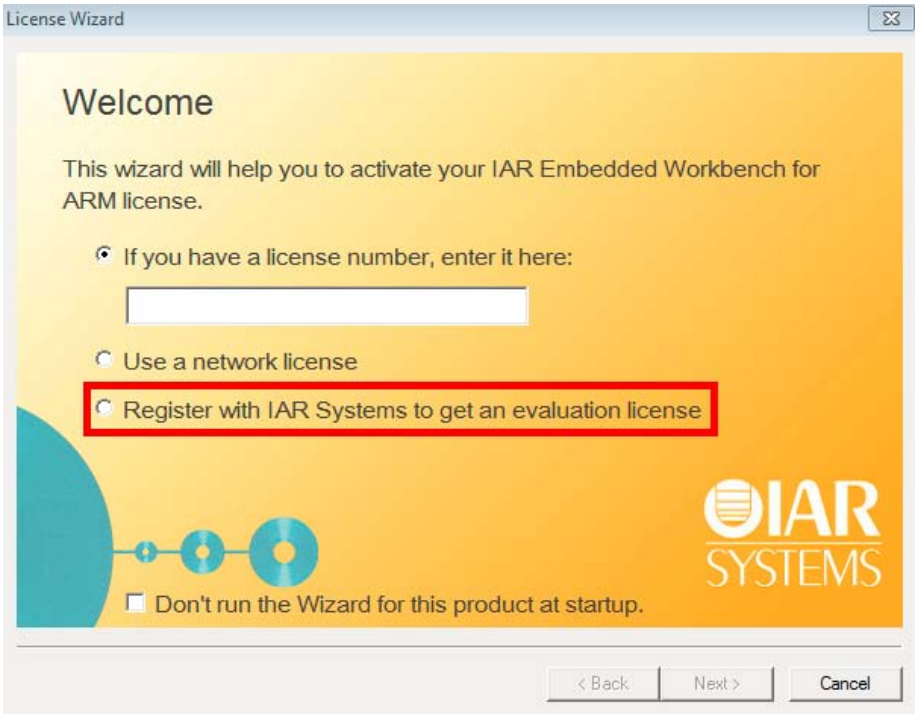
License Wizard
Welcome
This wizard will help you to activate your IAR Embedded Workbench for ARM license.
If you have a license number, enter it here:
Use a network license
Register with IAR Systems to get an evaluation license
IAR SYSTEMS
Don't run the Wizard for this product at startup.
< Back
Next >
Cancel

When asked to select an evaluation license type, you may choose either the **30-day time-limited evaluation** or the **Kickstart, size-limited evaluation.** Choose a license type that will best fit your needs. In order to run the example applications described in this guide, you will need to choose the **30-day time-limited evaluation** or purchase the full version. After registering and confirming your registration, you will be emailed a link which contains your assigned license number. Enter this license number into the textbox of the license wizard to activate IAR Embedded Workbench (make sure to include the hyphens when typing in the license number).

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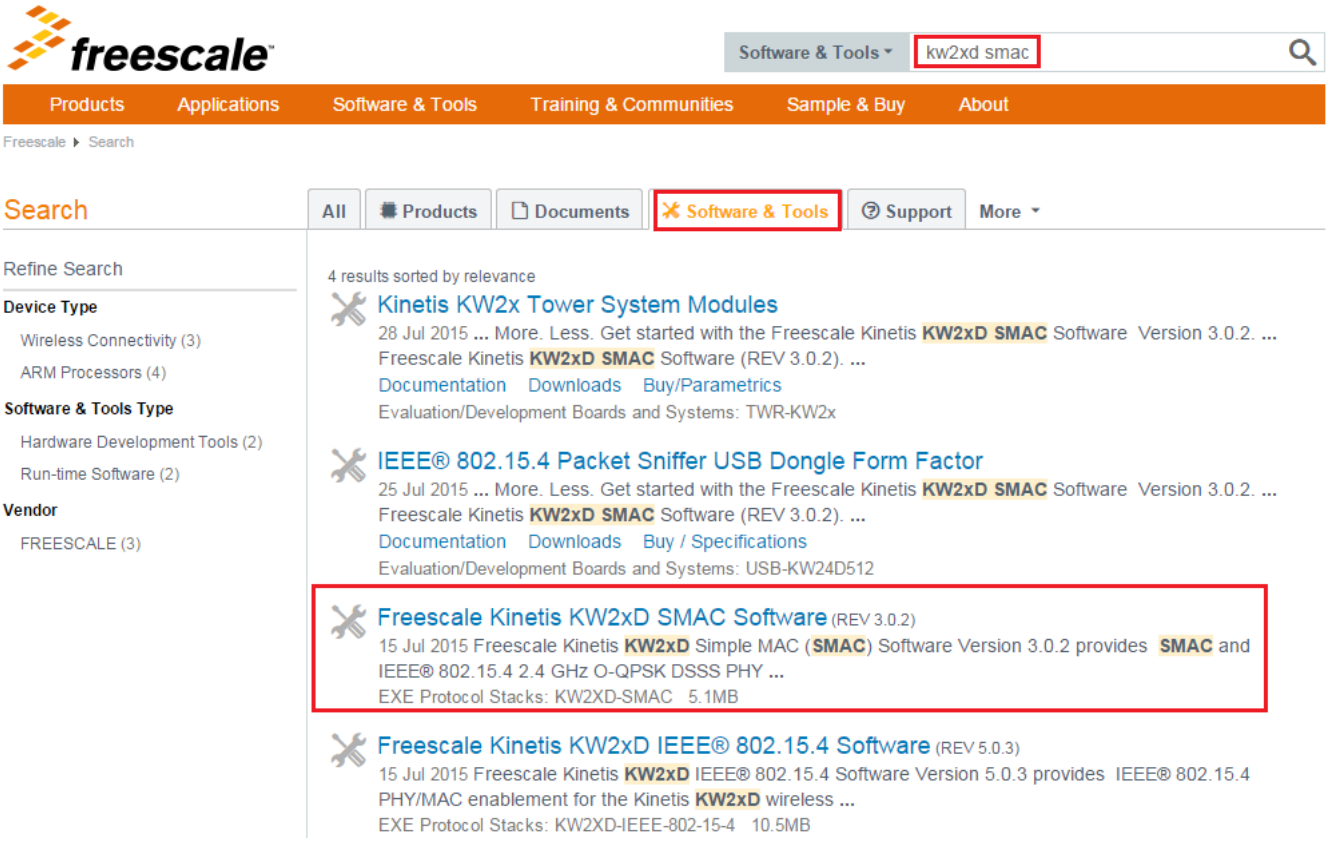
2.3 Downloading the Kinetis KW2xD SMAC Software

Now that IAR Embedded Workbench is installed and activated, you are now able to load programs into the device. First, we will download demonstration applications which are in the **Kinetis KW2xD SMAC Codebase** located on Freescale's website. This codebase provides simple communication and test applications for the Threaduino and other MKW2xD platforms. You can find the software by searching for "**KW2xD SMAC**" on the Freescale website under "**Software & Tools**".


freescale
Software & Tools
kw2xd smac
Products
Applications
Software & Tools
Training & Communities
Sample & Buy
About
Freescale ▸ Search
Search
All
Products
Documents
Software & Tools
Support
More
Refine Search
Device Type
Wireless Connectivity (3)
ARM Processors (4)
Software & Tools Type
Hardware Development Tools (2)
Run-time Software (2)
Vendor
FREESCALE (3)
4 results sorted by relevance
Kinetis KW2x Tower System Modules
28 Jul 2015 ... More. Less. Get started with the Freescale Kinetis KW2xD SMAC Software Version 3.0.2. ...
Freescale Kinetis KW2xD SMAC Software (REV 3.0.2). ...
Documentation Downloads Buy/Parametrics
Evaluation/Development Boards and Systems: TWR-KW2x
IEEE® 802.15.4 Packet Sniffer USB Dongle Form Factor
25 Jul 2015 ... More. Less. Get started with the Freescale Kinetis KW2xD SMAC Software Version 3.0.2. ...
Freescale Kinetis KW2xD SMAC Software (REV 3.0.2). ...
Documentation Downloads Buy / Specifications
Evaluation/Development Boards and Systems: USB-KW24D512
Freescale Kinetis KW2xD SMAC Software (REV 3.0.2)
15 Jul 2015 Freescale Kinetis KW2xD Simple MAC (SMAC) Software Version 3.0.2 provides SMAC and IEEE® 802.15.4 2.4 GHz O-QPSK DSSS PHY ...
EXE Protocol Stacks: KW2XD-SMAC 5.1MB
Freescale Kinetis KW2xD IEEE® 802.15.4 Software (REV 5.0.3)
15 Jul 2015 Freescale Kinetis KW2xD IEEE® 802.15.4 Software Version 5.0.3 provides IEEE® 802.15.4 PHY/MAC enablement for the Kinetis KW2xD wireless ...
EXE Protocol Stacks: KW2XD-IEEE-802-15-4 10.5MB

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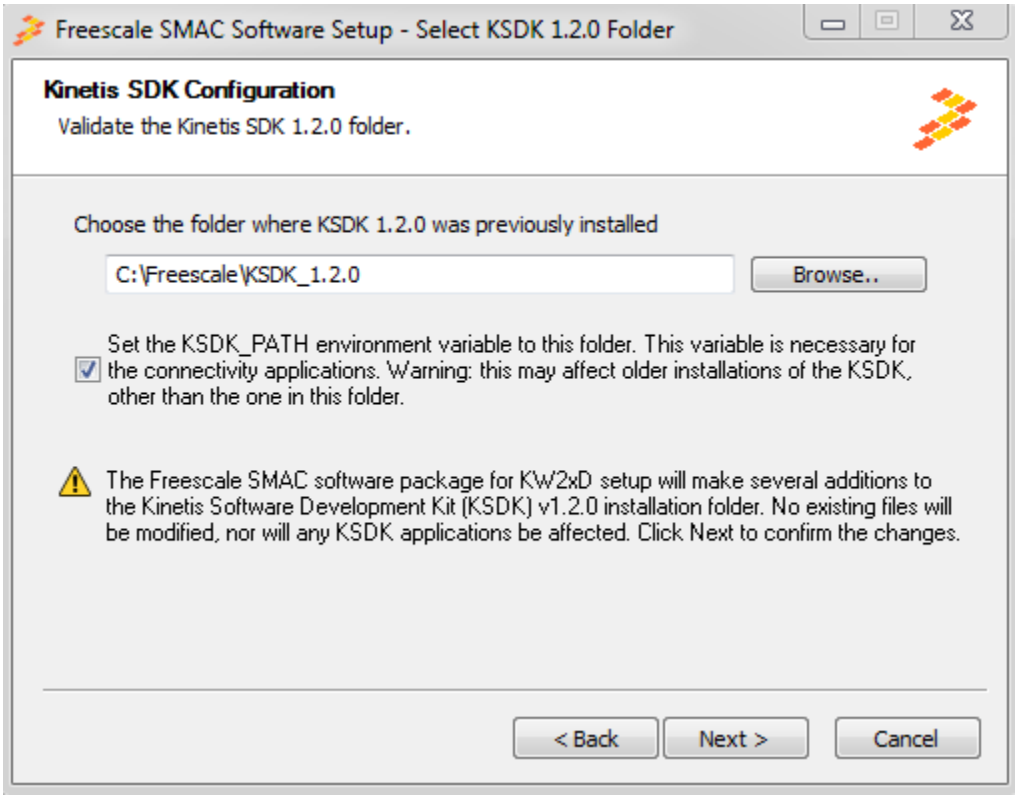
After the download is finished, run KW2xD-SMAC.exe and install the software. During the software setup, you will be asked to validate the location of your KSDK folder.


Freescale SMAC Software Setup - Select KSDK 1.2.0 Folder
Kinetis SDK Configuration
Validate the Kinetis SDK 1.2.0 folder.
Choose the folder where KSDK 1.2.0 was previously installed
C:\Freescale\KSDK_1.2.0
Browse..
Set the KSDK_PATH environment variable to this folder. This variable is necessary for the connectivity applications. Warning: this may affect older installations of the KSDK, other than the one in this folder.
The Freescale SMAC software package for KW2xD setup will make several additions to the Kinetis Software Development Kit (KSDK) v1.2.0 installation folder. No existing files will be modified, nor will any KSDK applications be affected. Click Next to confirm the changes.
< Back
Next >
Cancel

Once the installation is finished, open the KW2xD software folder which contains four example applications that you can test on the Threaduino.

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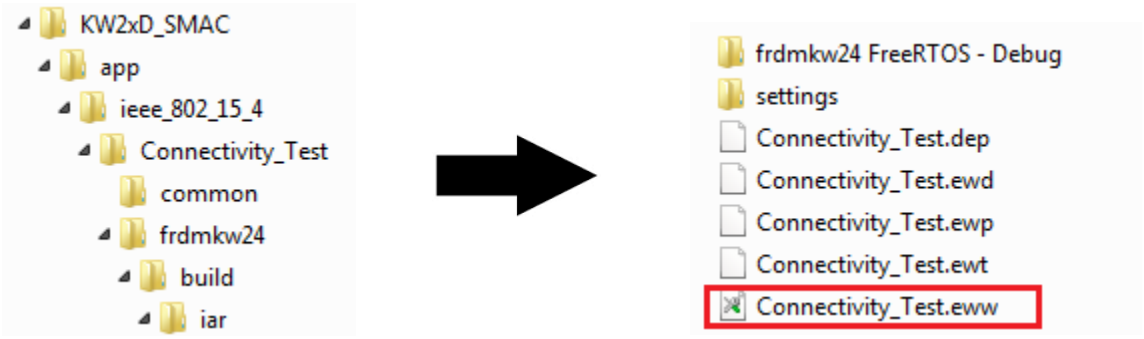
3 Example demonstration application

For this guide, we will be using the "**Connectivity Test**" example. Once inside the KW2xD SMAC folder, navigate to

<install-dir>/app/ieee_802_15_4/Connectivity_Test/frdmkw24/build/iar

Within this directory, there will be a file named **Connectivity_Test.eww**. Open this file using IAR Embedded Workbench.



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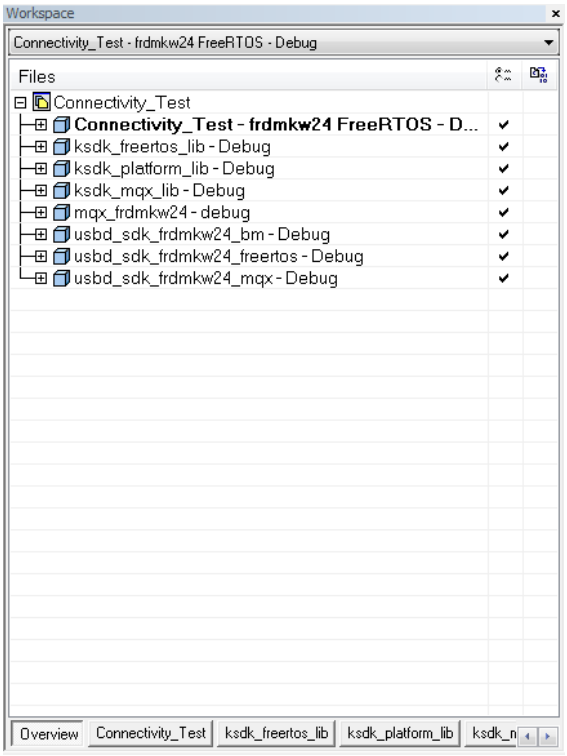
3.1 Configuring the settings in IAR Embedded Workbench

Once the workspace is opened in IAR, you should see several project files in the workspace window.



The four projects we are concerned with for now are:

- Connectivity_Test – frdkw24 FreeRTOS - Debug
- ksdk_freertos_lib - Debug
- ksdk_platform_lib - Debug
- usbd_sdk_frdmkw24_freertos – Debug

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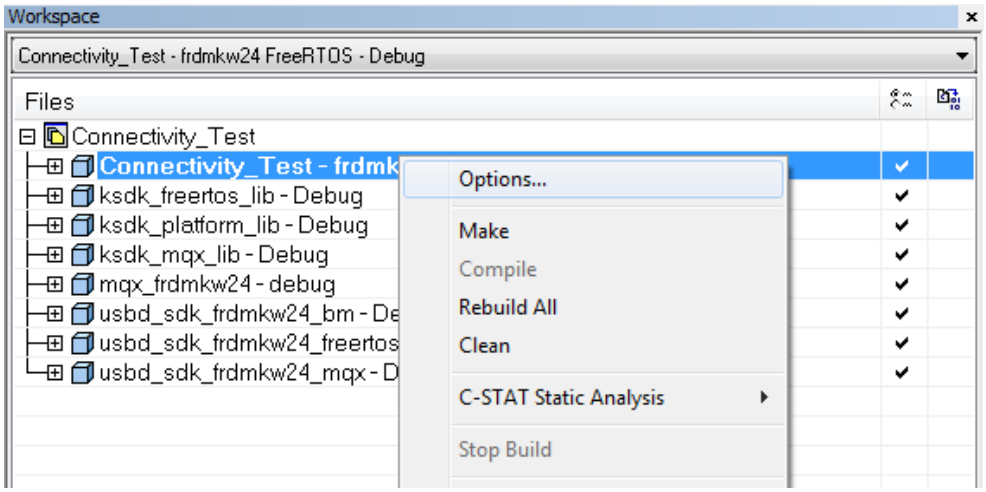
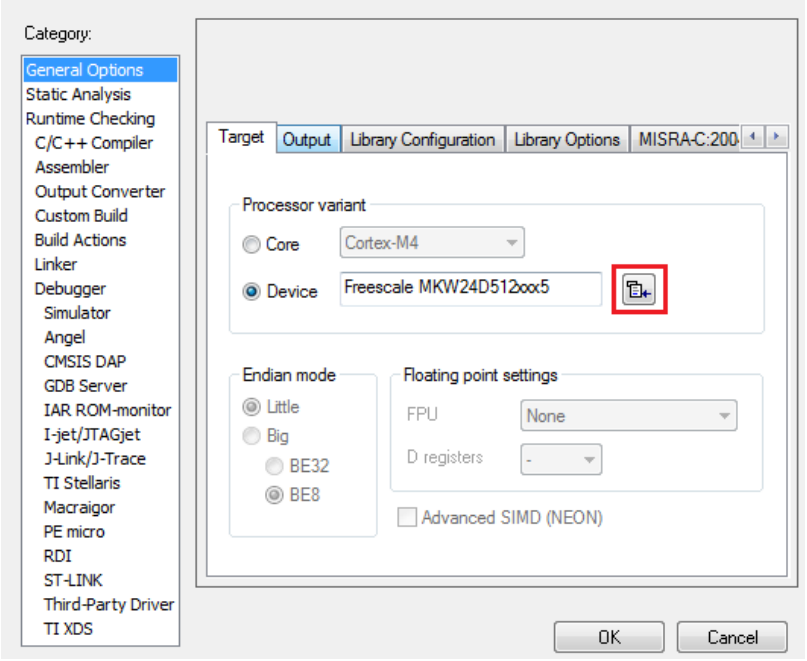
For each of these projects you must set the target device to **Freescale MKW24D512xxx5.** This can be done by right clicking each project and selecting "**Options"** and under the **General Options** category, select the **Target** tab.



Click on the button and select Freescale->KW2x->Freescale MKW24D512xxx5.



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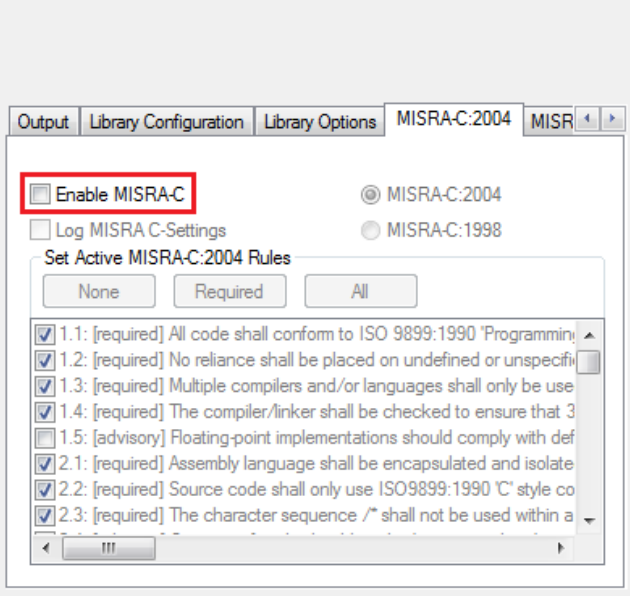
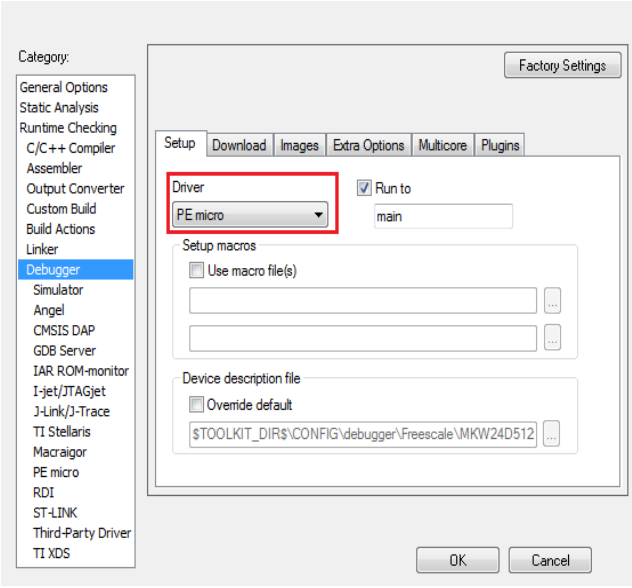
For each project, ensure that the option to **Enable MISRA-C** is **not** selected. Do this by clicking the MISRA-C:2004 tab under **General Options.**


Output
Library Configuration
Library Options
MISRA-C:2004
MISR
Enable MISRA-C
Log MISRA C-Settings
MISRA-C:2004
MISRA-C:1998
Set Active MISRA-C:2004 Rules
None
Required
All
1.1: [required] All code shall conform to ISO 9899:1990 'Programmin
1.2: [required] No reliance shall be placed on undefined or unspecifi
1.3: [required] Multiple compilers and/or languages shall only be use
1.4: [required] The compiler/linker shall be checked to ensure that 3
1.5: [advisory] Floating-point implementations should comply with def
2.1: [required] Assembly language shall be encapsulated and isolate
2.2: [required] Source code shall only use ISO9899:1990 'C' style co
2.3: [required] The character sequence /* shall not be used within a

Next, under the **Debugger** category **Setup** tab, select **PE micro** as the driver in the dropdown list.



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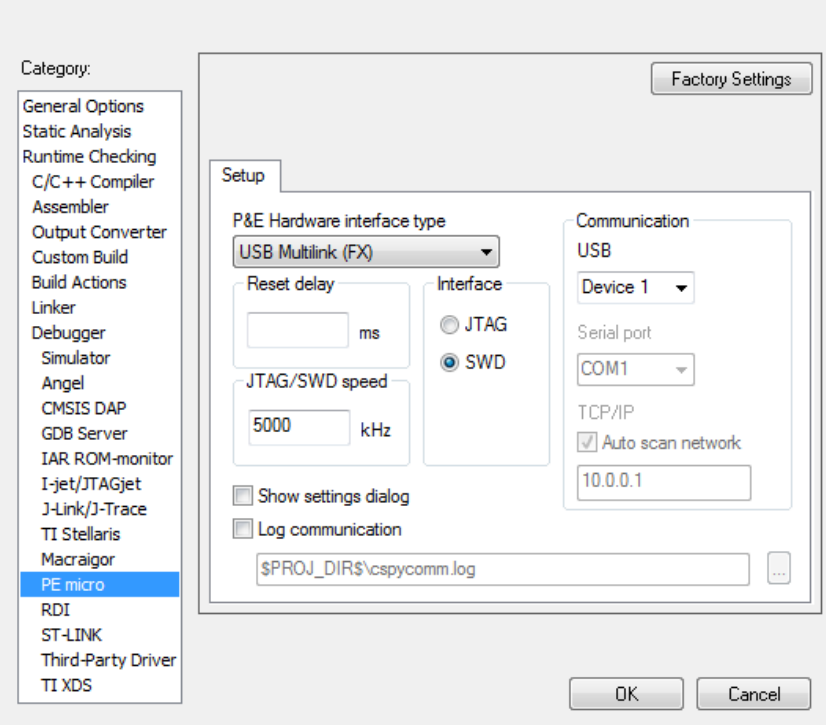
Then, under the PE micro subcategory make sure the following settings are selected.



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3.2 The first time connecting the device to your system

Use a micro USB male to USB male cable to connect the Threaduino to a USB port on your computer. Your computer should automatically install the necessary drivers for the device and you will see the device listed as a Virtual Com Port in the Device Manager.

Then, connect P&E's USB Multilink Universal development interface to a separate USB port on your computer and connect it to the SWD connector on the Threaduino. Once again, the drivers will automatically install for this device.

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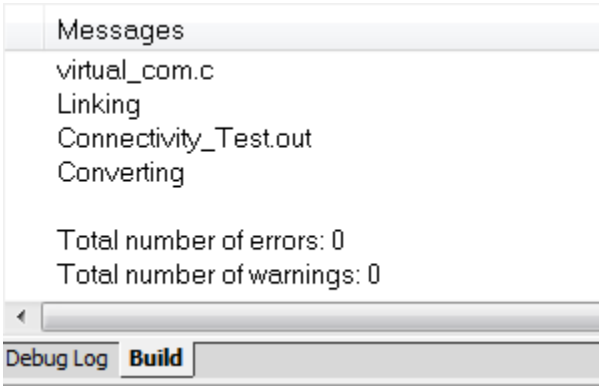
3.3 Loading the application into the device

Right-click each project and select **Rebuild All.** Only rebuild **Connectivity_Test – frdkw24 FreeRTOS – Debug** after you have already successfully built the other three projects. After building **Connectivity_Test – frdkw24 FreeRTOS – Debug,** you should see the following message if everything was successful:



Once you receive the message above click the **Make** button located on the toolbar at the top of IAR.

Next, click the **Download and Debug** button on the same toolbar.

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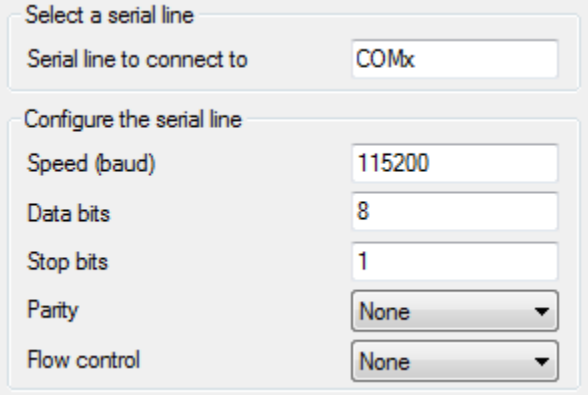
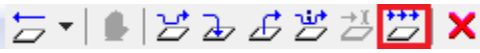
You will see a message that the debugger session is starting and the flash memory is being programmed. Open a serial terminal application such as Putty or HyperTerminal and enter the following settings:



Where **COMx** is the virtual com port number found in section 3.2. Earlier when you clicked the **Download and Debug** button, a new toolbar should have appeared above the workspace window. On this new toolbar click the **Go** button.



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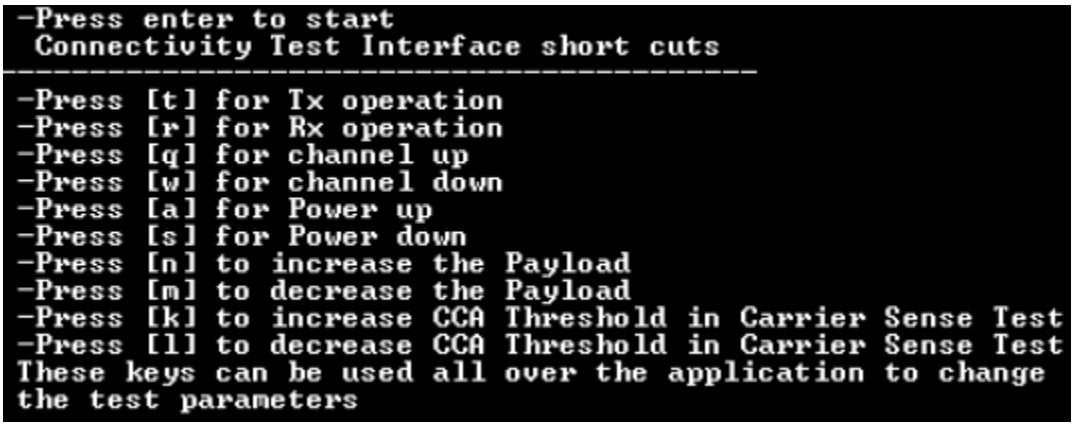
The following menu should appear on the serial terminal application:


-Press enter to start
Connectivity Test Interface short cuts
-Press [t] for Tx operation
-Press [r] for Rx operation
-Press [q] for channel up
-Press [w] for channel down
-Press [a] for Power up
-Press [s] for Power down
-Press [n] to increase the Payload
-Press [m] to decrease the Payload
-Press [k] to increase CCA Threshold in Carrier Sense Test
-Press [l] to decrease CCA Threshold in Carrier Sense Test
These keys can be used all over the application to change
the test parameters

You have now successfully loaded an application into the Threaduino. To learn more about the Connectivity Test application, see Chapter 4 in the **MKW2xDSMACDAUG.pdf** located in <KW2xD_SMAC>/doc. This MKW2xD SMAC User Guide will also explain the other demo applications that were a part of the SMAC software download. The process of loading these applications into the Threaduino is the same as the one we have done.

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4 BeeKit Wireless Connectivity Toolkit

In order to use the device's full capabilities, you must install BeeKit Wireless Connectivity Toolkit. Similar to the SMAC software, the BeeKit toolkit provides demonstration projects that will allow the user to quickly see the capabilities of the device. Furthermore, installing the toolkit before connecting the device will allow your system to automatically install the necessary drivers the first time the device is connected. In this section, we will go through a step-by-step guide to generating a program using the toolkit and loading it into the device.

4.1 BeeKit Installation

First you will need to download and install the BeeKit Wireless Connectivity Toolkit. This could be found on the Freescale website by simply searching for "**BeeKit**." Once it is installed, run **BeeKit.exe** located in <install-dir>/Freescale/BeeKit. This will open the application and take you to the start page which will instruct you on how to get started.

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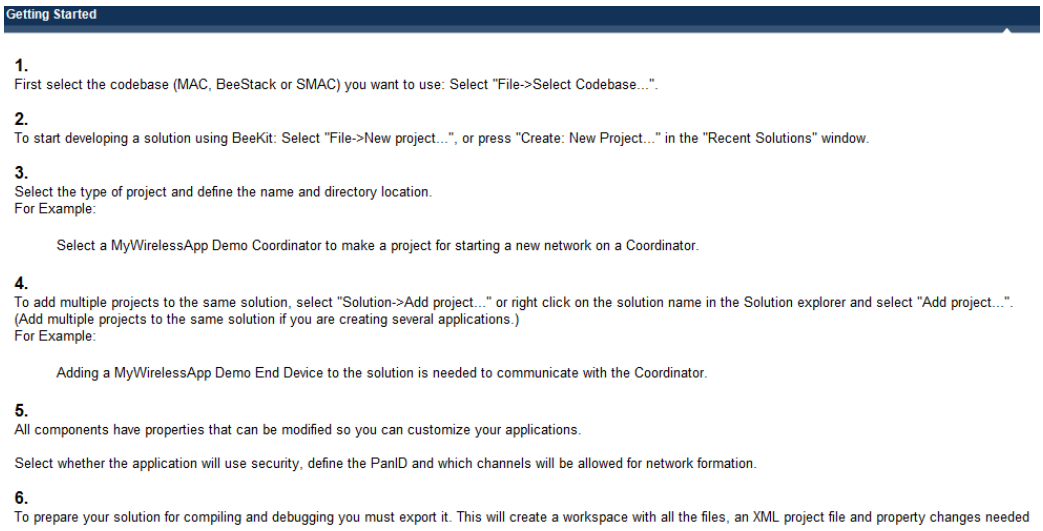
Getting Started
1.
First select the codebase (MAC, BeeStack or SMAC) you want to use: Select "File->Select Codebase...".
2.
To start developing a solution using BeeKit: Select "File->New project...", or press "Create: New Project..." in the "Recent Solutions" window.
3.
Select the type of project and define the name and directory location.
For Example:
Select a MyWirelessApp Demo Coordinator to make a project for starting a new network on a Coordinator.
4.
To add multiple projects to the same solution, select "Solution->Add project..." or right click on the solution name in the Solution explorer and select "Add project...".
(Add multiple projects to the same solution if you are creating several applications.)
For Example:
Adding a MyWirelessApp Demo End Device to the solution is needed to communicate with the Coordinator.
5.
All components have properties that can be modified so you can customize your applications.
Select whether the application will use security, define the PanID and which channels will be allowed for network formation.
6.
To prepare your solution for compiling and debugging you must export it. This will create a workspace with all the files, an XML project file and property changes needed

4.2 Creating a Demonstration Solution

Follow the instructions as shown on the **Start Page.** For further detailed instructions see the **BKWCTKQSG.pdf** located in <install-dir>/Freescale/Documentation/BeeKit Documentation.

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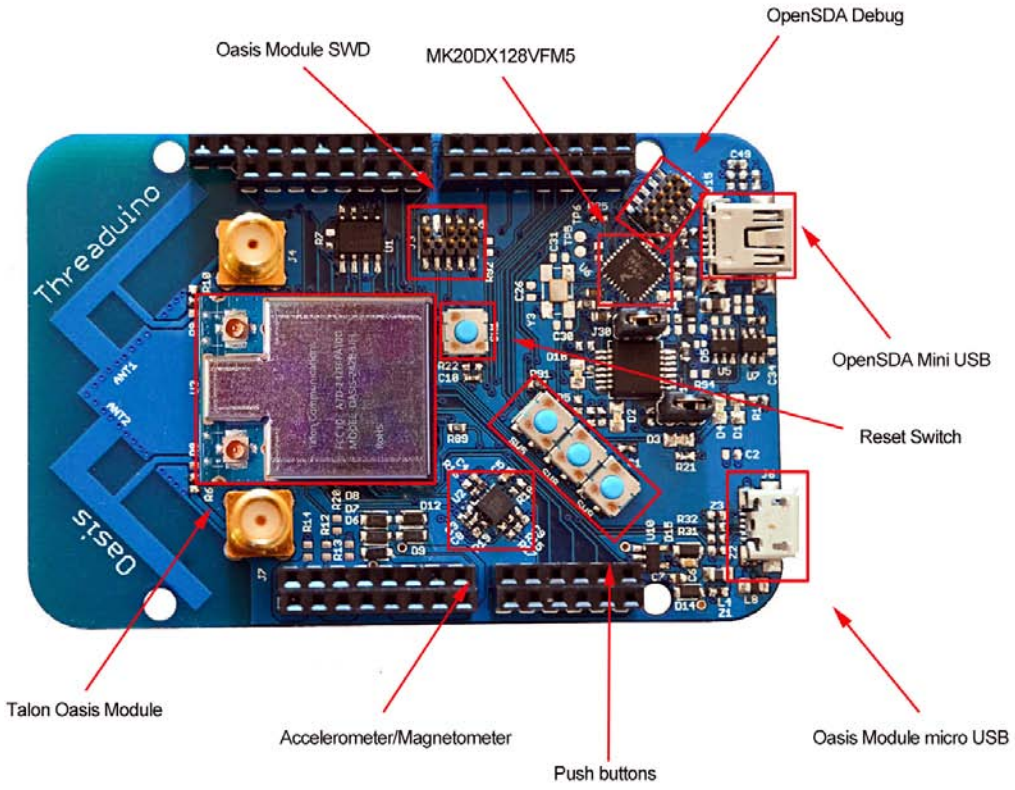
5 System Overview

This section details the locations and descriptions of each major component and connector on the Threaduino board. These components include the switches, jumpers, LEDs, and connectors.



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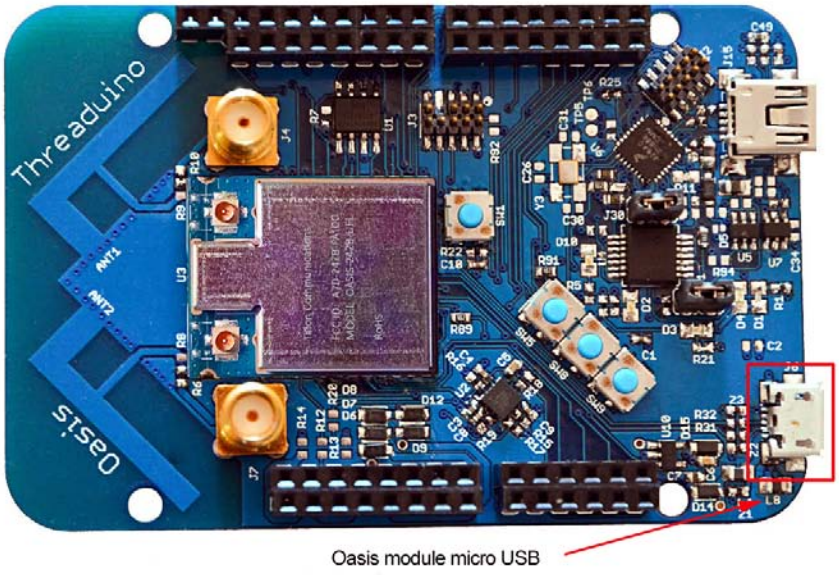
5.1 Power Supply

There are various ways to supply power to the board. The following subsections will describe each method in detail. For additional information about the power management circuit see the schematics in section 5.

5.1.1 Micro USB connector

The device contains a USB micro-B connector on the board. This connector is used to supply power to the Talon Oasis Module.



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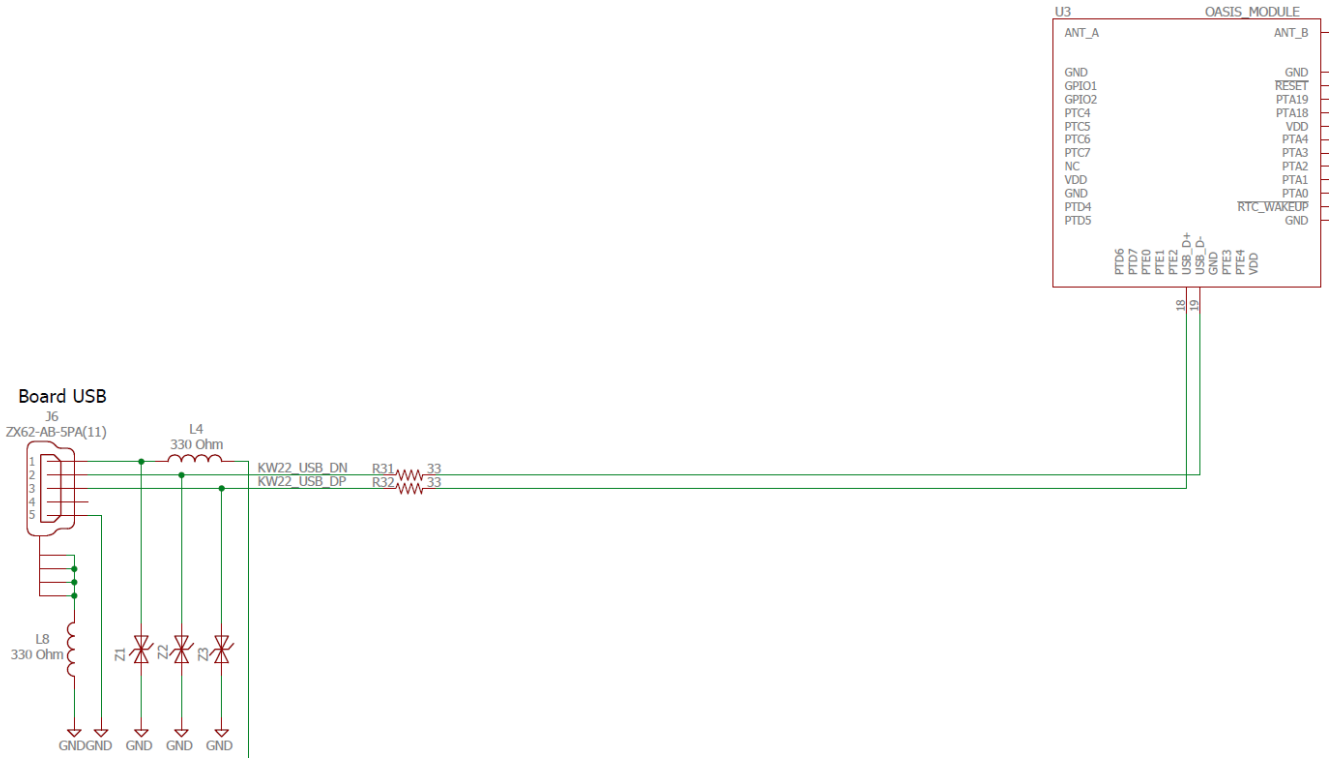

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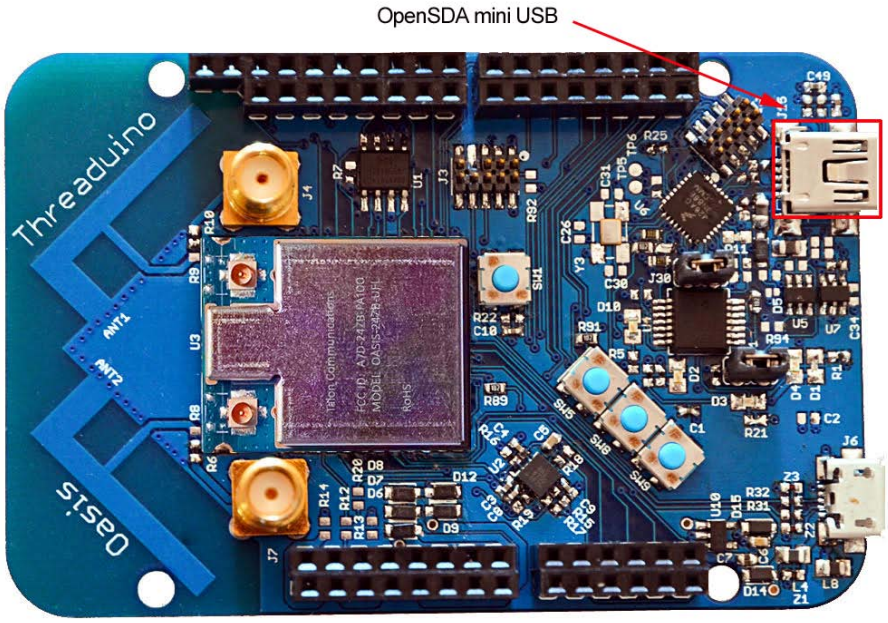
5.1.2 Mini USB Connector

In addition to the micro USB connector, the Threaduino also has a mini USB connector. The mini USB connector is used to supply power to the MK20DX128VFM5 microcontroller to support the OpenSDA feature of the board.



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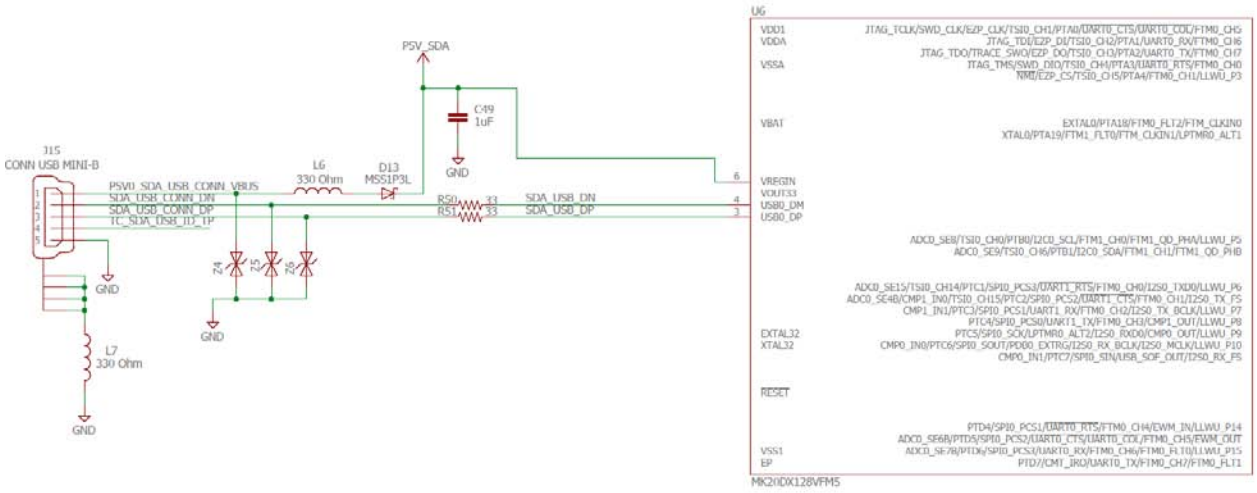

5.2 Debug/Development Interface

SWD connectors are used to connect emulators/probes to enable target system debugging.

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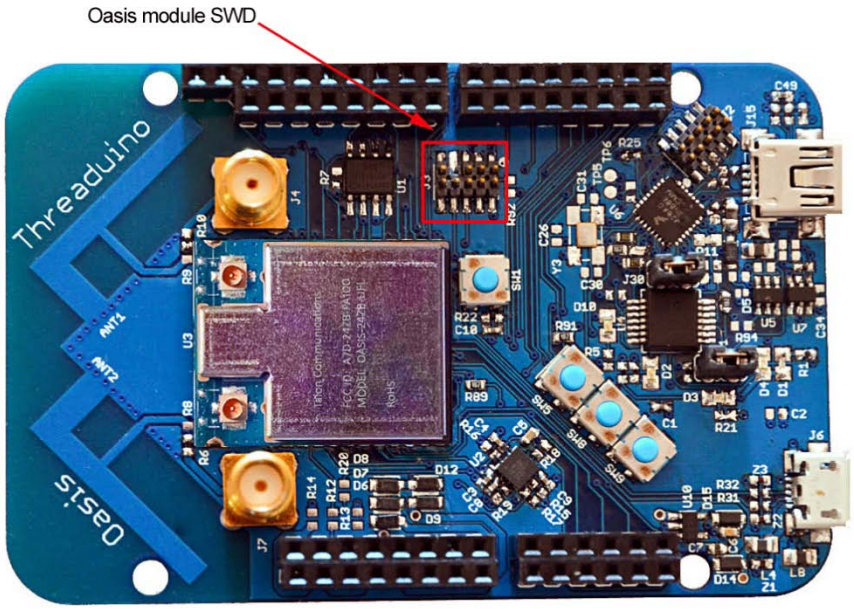
5.2.1 SWD Connector for the Talon Oasis Module



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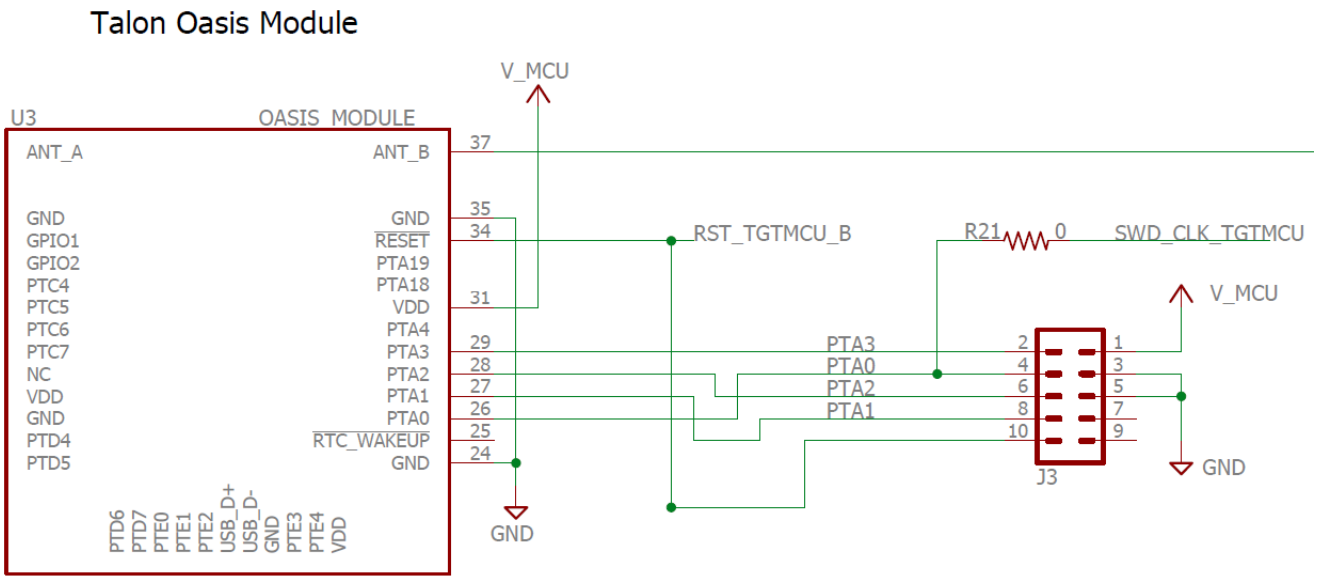
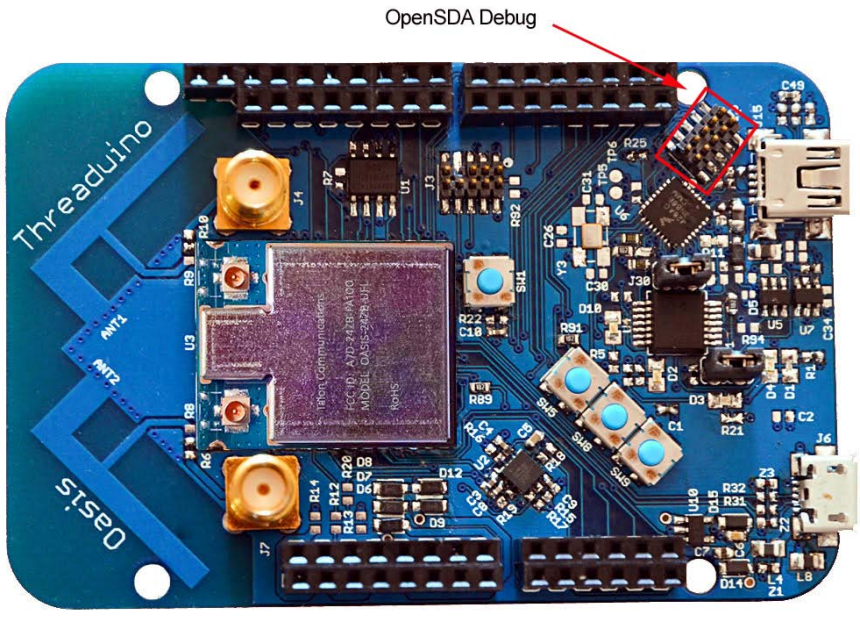


5.2.2 SWD Connector for the MK20DX128VFM5 microcontroller



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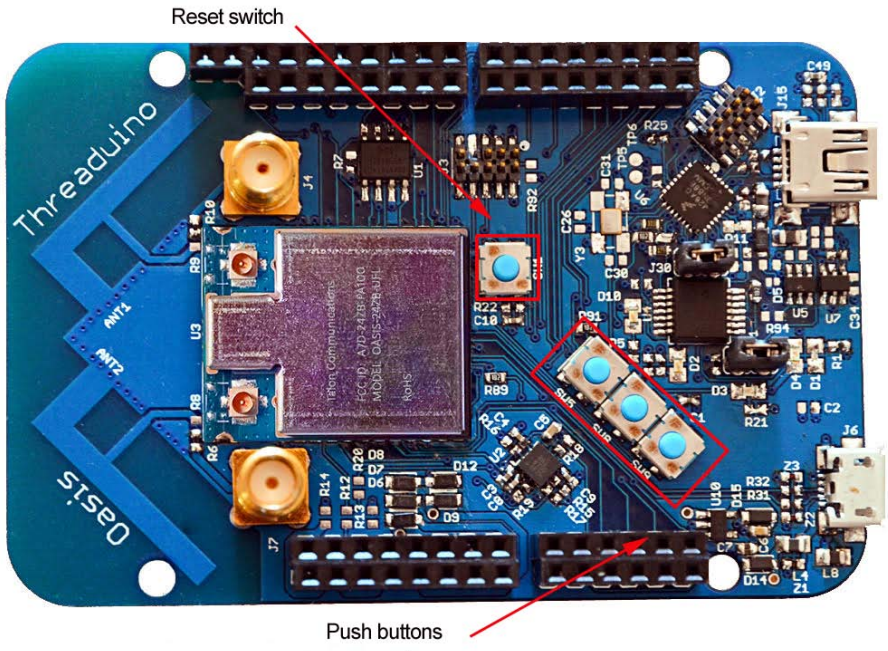
For further details about the connections, see page 2 of the schematics in section 6.

5.4 Buttons

The development platform features 4 push buttons. SW1 is a reset switch, and the other three are general purpose input/output switches. In addition, SW5 can function as a RTS signal for UART1.



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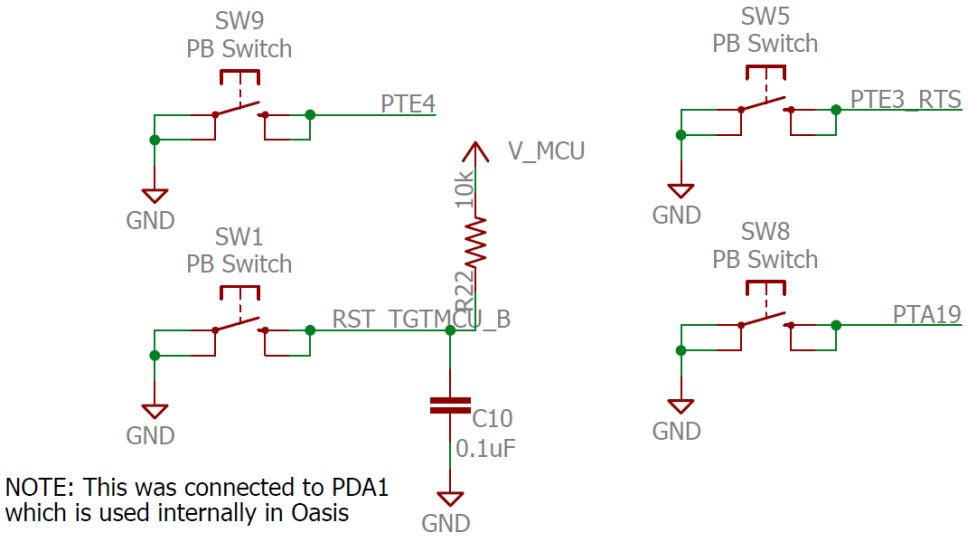
SWITCHING GPIO



NOTE: This was connected to PDA1 which is used internally in Oasis

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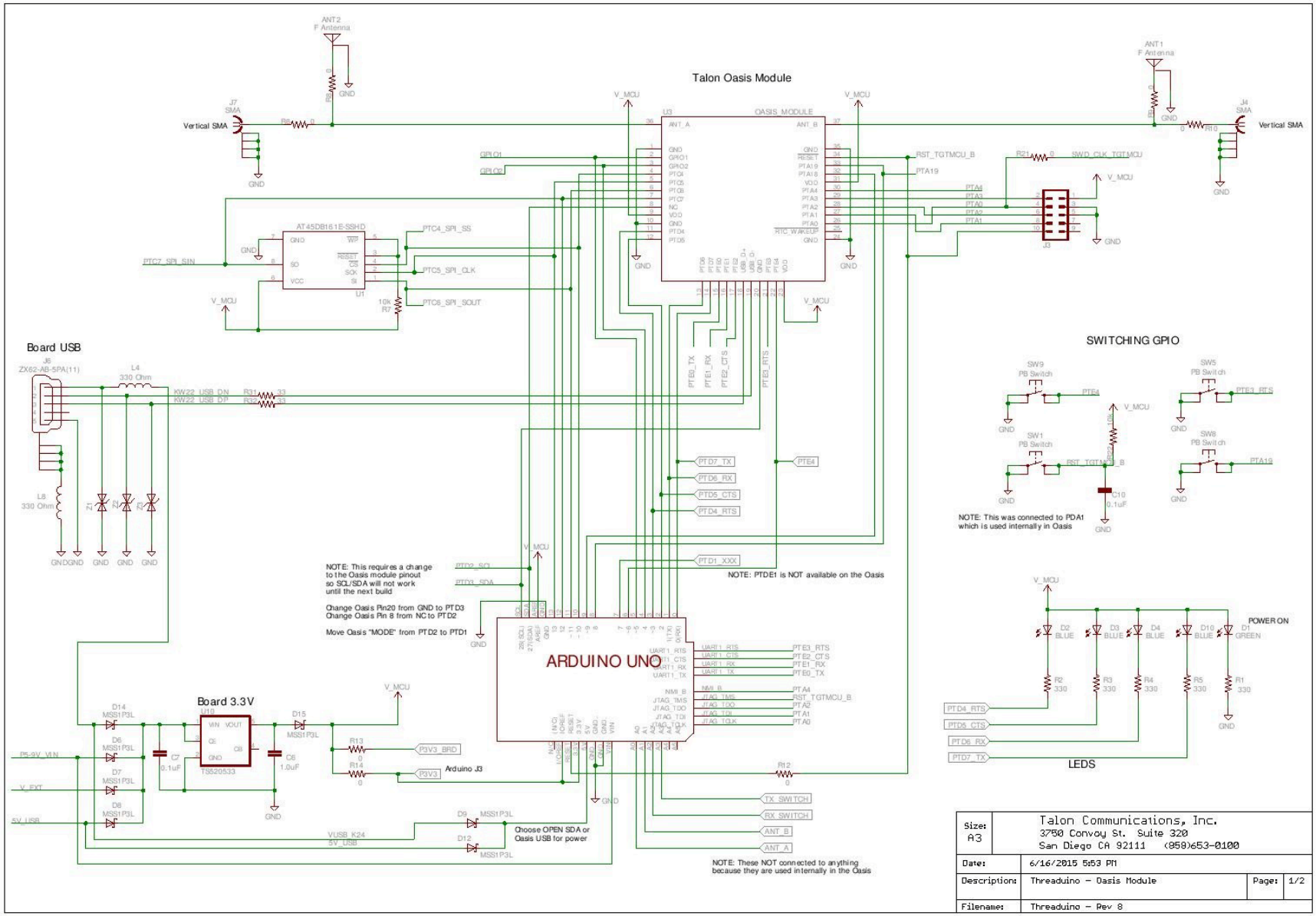
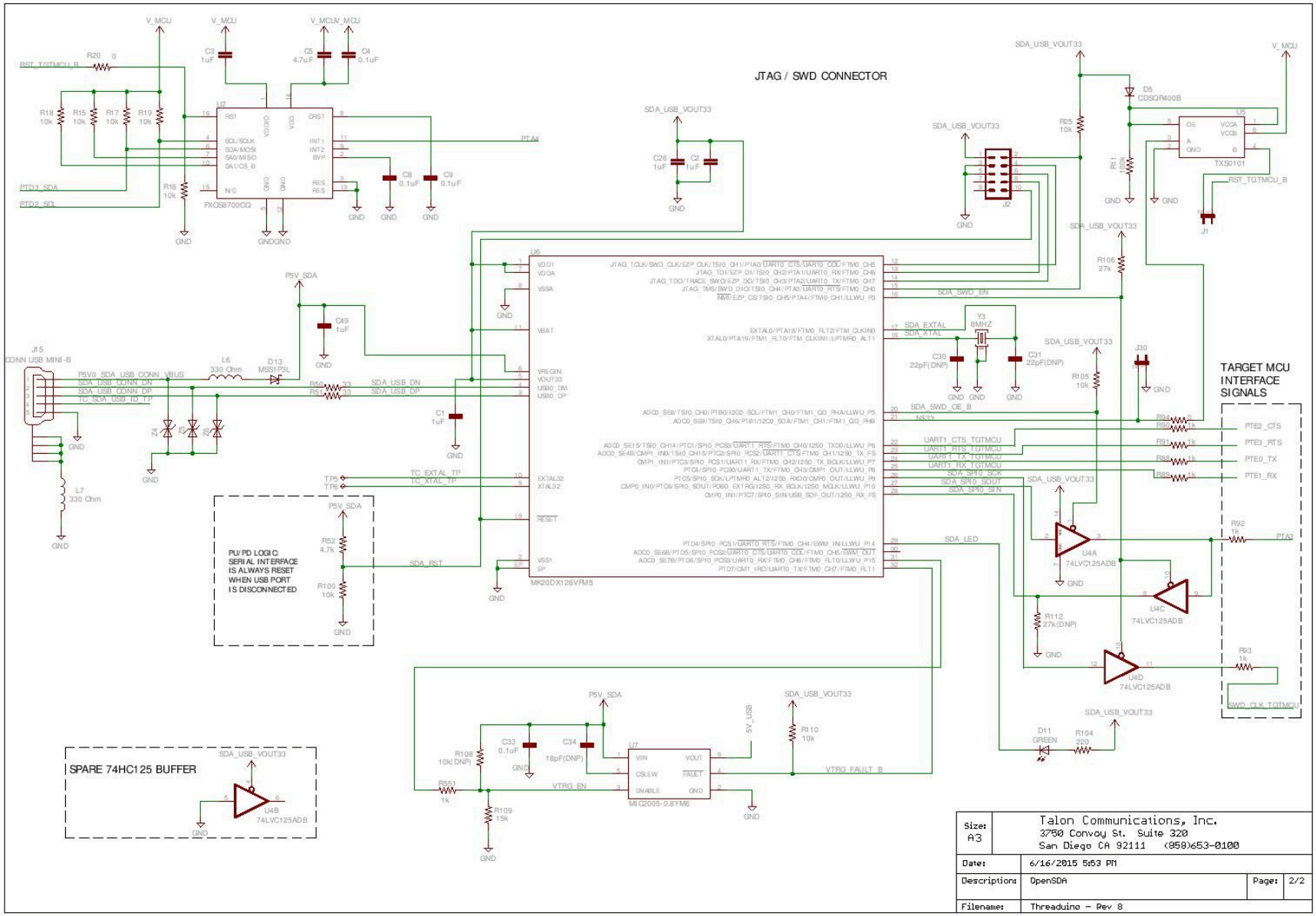
6 Schematics




JTAG / SWD CONNECTOR
TARGET MCU INTERFACE SIGNALS
PU/PD LOGIC SERIAL INTERFACE IS ALWAYS RESET WHEN USB PORT IS DISCONNECTED
SPARE 74HC125 BUFFER
MK20DX128VFM5
FXOS8700CQ
TXS0101
74LVC125ADB
MIC2005-0.8YM6
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